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(54) Optical recording disk

(57) An optical information recording disk having reduced eccentricity and center hole wear, comprises a metal plate lamination hub member 24 fixed in a central hole in the substrate 21 of the disk, said lamination member being formed of metal plate 28 (e.g. magnetic) and resin hub member 26 having centre holes dimensioned and aligned such that center hole 27 in the metal plate forms the center hole of the disk, and the metal plate and the resin hub member being attached to one another by ultrasonic welding. Metal plate 28 may have a hardened layer at least around its center hole (Fig. 6). Metal plate 28 has protusions (29) (e.g. Fig. 4) each with a hole (30), and resin member 26 has corresponding engagement holes (34) (Fig. 5). Guide holes (31) (e.g. Fig. 3) are provided for positioning during welding so offsetting centre hole 27 damage. A double sided disc may be provided (Fig. 7).

FIG. 2

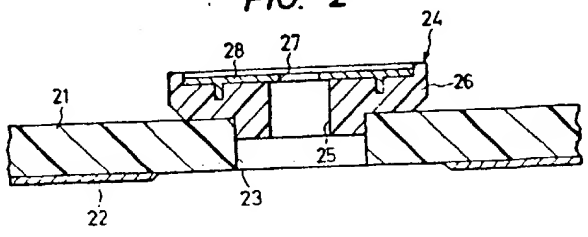

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FIG. 6

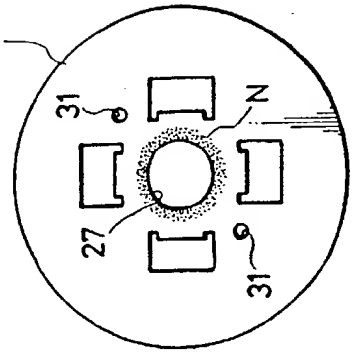


FIG. 5

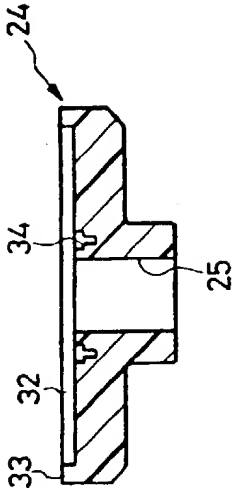


FIG. 4

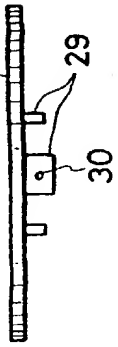
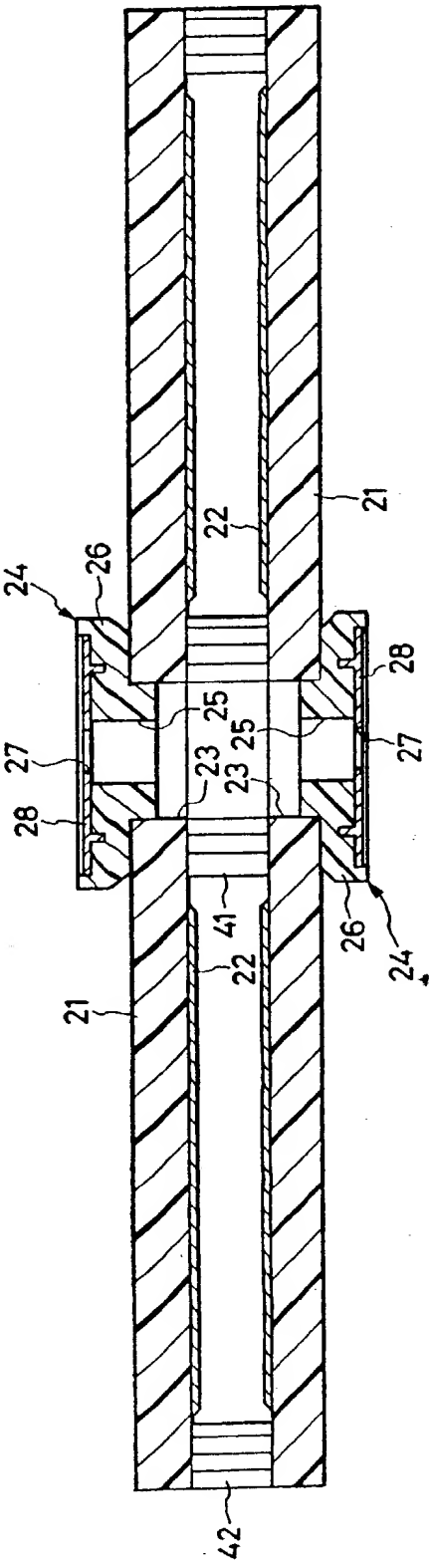


FIG. 7



the plastic disk substrate by cutting, punching, or the like during the injection molding process. These techniques do not, however, consistently produce center holes with the desired degree of circularity.

In order to overcome this problem, there has been proposed an optical disk having a structure, as shown in Fig. 1, in which a hub member 4 formed of a lamination of metal plates is fitted into a center hole 3 in a disk substrate 1. The metal plate lamination hub member 4 is constituted by a resin hub member 6 having a center hole 8, and a metal plate 5 affixed to a flat surface of the hub member 6 and having a center opening 7 which acts as the center hole of the optical disk. Because the center hole which forms the center hole of the optical disk is formed by drilling, it can have an excellent circularity, and hence the eccentricity of the disk is significantly reduced. Moreover, use of the metal plate makes it possible to employ a magnetic clamper mechanism for clamping the disk on the turntable. In such a case, it is unnecessary to use in the clamper mechanism any member which presses the disk from the upper side thereof, thus making it possible to reduce the overall height of the recording/reproducing apparatus.

However, in the metal plate lamination hub member, the metal plate and the resin hub are a combination of an inorganic member and an organic member. It is of course

hub member is improved.

In accordance with the above and other objects, the invention provides an optical information recording disk comprising a recording layer formed on one surface of the disk with a center hole formed in the central portion of the disk and with a metal plate lamination member being fitted in and fixed to the center hole in the disk. The metal lamination plate member is constituted by a metal plate and a resin hub member. The metal plate and the resin hub member having respective center holes communicated with each other such that the center positioning of the optical disk is carried out with respect to the center hole of the metal plate. The metal plate and the resin hub member are affixed to each other by ultrasonic welding. Further, the metal plate may be provided with a hardened layer surrounding the center hole of the metal plate so that the center hole of the metal plate is prevented from wearing due to abrasion with the spindle holding the disk during recording/reproduction.

In the accompanying drawings:-

Fig. 1 is a cross-sectional view of a conventional optical information recording disk;

Fig. 2 is a cross-sectional view of an optical information recording disk constructed in accordance with the present invention;

Fig. 3 is a plan view of a metal plate used in the

surface of the hub member 26 by ultrasonic welding. A small circular hole 27, which will be used as the center hole of the optical disk, is formed in the circular metal plate.

The metal plate 28 is made of a stainless steel such as SUS 430, which is a magnetic material and resistant to rust, and the small circular hole 27 is formed in the central portion of the metal plate 28, as shown in Figs. 3 and 4. The inner diameter of the small hole 27 is made smaller than that of the center hole 25 of the resin hub member 26 so that the small circular hole 27 will act as the center hole for the driving of the optical disk. A plurality of protrusions 29 are equidistantly arranged around the small circular hole 27 by punching. A small hole 30 is formed in each of the protrusions 29. A plurality of guide holes 31 used for positioning are equidistantly formed in the metal plate 28.

As shown in Fig. 2, the resin member 26 is formed so that the outer diameter of its circular flat portion is larger than the inner diameter of the center hole 23 of the disk substrate 1, and the outer diameter of its cylindrical projecting portion is determined such that the cylindrical projecting portion fits into the center hole 23. As shown in Fig. 5, an annular recess 32 is formed in one surface of the circular flat surface so that the circular metal plate 28 is fitted into the recess 32, and an annular projecting portion 33 is formed in the periphery of the recess 32. The inner

24 are firmly fixed to each other.

Thus, the metal plate 28 is welded at its outer circumferential portion to the resin hub member 26 and further welded to the latter at its inner circumferential portion through the plural protrusions 29. As a result, the metal plate 28 and the resin hub member 26 are positively prevented from separating from one another in both the axial and rotational directions.

Since the relative positioning between the metal plate 28 and the resin hub member 26 for the ultrasonic welding process is carried out not with their center holes but with the guide holes 31 and the through-holes, the center hole 27 of the metal plate is protected from damage.

Moreover, since the inlet portion of each of the engagement holes 34 formed in the resin hub member 26 into which the protrusions 29 of the metal plate are inserted are made wide, excess resin created during the ultrasonic pressing process will flow into the engagement holes 34 and accumulate in the wide inlet portions of the engagement holes 34, and hence there is no reduction in the welding strength due to rising of the metal plate caused by excess resin.

The shape of the protrusions 29 of the metal plate 28 can be variously modified. For example, in order to facilitate the insertion of the protrusions 29 during the pressing process, the protrusions 29 may be formed with angled tip

2 μm after inserting and removing the disk from the spindle 2000 times. If no such hardening processing is employed, the amount of enlargement has been found to be about 11 to 15 μm under the same conditions.

Also, as shown in Fig. 7, a double-sided disk may be formed by preparing two disks as described above and combining them through an inner annular spacer 41 and an outer annular spacer 42. Each spacer is fixed to the substrate 21 by an adhesive agent or ultrasonic welding method. Moreover a recording film may be provided on only one of the disk substrates. Also, a metal plate lamination member may be provided on only one of the disk substrates.

As described above, in the optical information recording disk of the present invention, the metal plate lamination hub member is constituted by a metal plate and a resin hub member which are affixed to one another using ultrasonic pressure welding. As a result, separation of the metal plate and the resin hub member, both in the axial direction and in the rotational direction, is positively prevented.

Moreover, in the optical information recording disk according to a second aspect of the invention, a hardened layer is formed at the periphery of the center hole of the metal plate by nitriding processing. Thus, because the amount of wear due to abrasion with the hub is significantly

CLAIMS

1. An optical information recording disk comprising: a disk substrate having a recording layer formed on at least one surface thereof and having a center hole formed in a central portion thereof; and a metal plate lamination member inserted into and fixed in said center hole of said substrate, said metal plate lamination member comprising a metal plate and a resin hub member, said metal plate and said resin hub member having respective center holes communicated with one another in such a manner that center positioning of said disk is effected with respect to said center hole in said metal plate, said metal plate and said resin hub member being fixedly attached together by ultrasonic welding.

2. The optical information recording disk of claim 1, wherein said metal plate is made of material which is magnetic and resistant to rust.

3. The optical information recording disk of claim 1, wherein a plurality of protrusions are formed in said metal plate.

4. The optical information recording disk of claim 1, wherein said protrusions are bent downward from a plane of said metal disk and have small holes formed in end portions thereof.

5. The optical information recording disk of claim 4,

8. The optical information recording disk of claim 7, wherein said hardened layer is formed by a nitriding process.

9. The optical information recording disk of claim 7, wherein said hardened layer extends over the surface of said metal plate.

10. The optical information recording disk of claim 7, wherein said hardened layer has a Vickers hardness of approximately 1000.

11. The optical information recording disk, comprising: a pair of disk substrates, at least one of said disk substrates having a recording layer formed on at least one surface thereof and having a center hole formed in a central portion thereof; at least one metal plate lamination member inserted into and fixed in said center hole, said metal plate lamination member comprising a metal plate and a resin hub member, said metal plate and said resin hub member having respective center holes communicated with one another in such a manner that center positioning of said disk is effected with respect to said center hole in said metal plate, said metal plate and said resin hub member being fixedly attached together by ultrasonic welding; an inner annular spacer; and an outer annular spacer, said pair of disk substrates being fixed to each other through said inner annular spacer and said outer annular spacer.